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Freshwater Mussel (Bivalvia: Unionidae) Causes Incidental Fish Mortality

JAMES (JAY) R. CORDEIRO

NatureServe, 11 Avenue de Lafayette, 5th Floor, Boston, MA 02111 and Division of Invertebrate Zoology, American Museum of Natural History, Central Park West at 79th Street, New York, NY 10024, USA
(e-mail: jay_cordeiro@natureserve.org)

Abstract. A rare observation of incidental fish mortality caused by a native Atlantic slope freshwater mussel is herein reported from a small pond in Middleboro, Massachusetts, and the resulting mortality of the fish is discussed in the context of other vertebrate mortalities induced by aquatic invertebrates as reported in the literature.

On 14 August 2003, while surveying the south side of Tispaquin Pond (at the boat launch) in Middleboro (Plymouth Co.), Massachusetts, for specimens of the invasive Asiatic clam, *Corbicula fluminea* (Müller, 1774) (Bivalvia: Corbiculidae), a single living specimen of the eastern Elliptio mussel, *Elliptio complanata* (Lightfoot, 1786) (Bivalvia: Unionidae), was hand-collected in sandy substrate at one meter depth. Upon extracting the specimen for examination, a dead, juvenile yellow perch, *Perca flavescens* (Mitchill, 1814), about 5 cm long, was found lodged tightly between the valves (Figure 1). Both specimens were immediately retained, narcotized with Epsom salts, fixed in an ethyl alcohol series, preserved in 70% ethyl alcohol, and retained in the author's personal collection.

The yellow perch appeared to have died recently, as evidenced by the lack of glossing over its eyes and the relatively good condition of scales and fins. No evidence of decomposition was evident whatsoever. Cause of death appeared to be from the trauma caused by the mussel valve closure around the body of the fish. The eastern Elliptio was 8.3 cm long with valves clamped tightly around the body of the fish at right angles to the midline and directly through the region of the dorsal fin. The mussel valves remained clamped throughout the fixation and preservation process and the fully preserved fish continues to remain clamped between the valves of the preserved mussel at the time of submittal of this manuscript (October 2006). The mussel did not appear adversely affected by the presence of the yellow perch, although the valves could not close completely and remained agape even after retrieval from the substrate. Although numerous (hundreds) other specimens were collected from the site at that time and subsequently, no other specimens have ever been found with valves clamped around juvenile fishes.

Incidents of mortality in fish and other aquatic vertebrates are commonly attributed to predation by other vertebrates. Vertebrate mortality caused by invertebrates, especially upon adult aquatic vertebrates, is extremely rare. Predation of hatchling or juvenile reptiles, particularly turtles, is known for decapod crustaceans (Stancyk, 1982) and hemipterans (Gotte, 1992). Active predation by aquatic invertebrates is known for diving beetles (*Dytiscus* sp.) and dragonfly nymphs (*Anax* sp., and others) on various amphibians (e.g., salamanders, tadpoles) (Smith & Van Buskirk, 1995; Storfer & White, 2004; Van Buskirk & Schmidt, 2000). Recently, Mueller et al. (2006) documented significant predation on eggs and larvae of the endangered razorback sucker, *Xyauchen texanus* (Abbott, 1860), by the introduced red swamp crayfish, *Procambarus clarkii* (Girard, 1852). Back in 1894, J.H. Sage (1895: 49, unnumbered fig.) published a short observation near Portland, Connecticut, of a living sora, *Porzana carolina* (Linnaeus, 1758), with a living adult freshwater mussel (later identified as *Elliptio complanata*) clamped tightly to its left foot. The bird was unable to fly and was hopping about with its toe nearly severed. Frierson (1899: 139–140) reported twice killing ducks with freshwater mussels attached to their toes and postulated this as a means of long-distance dispersal. Carbine (1942) documented attachment of the fingernail clam, *Musculium securis* (Prime, 1852), to the jaws of two live individuals of northern pike, *Esox lucius* Linnaeus, 1758, in Houghton Lake, Michigan. DeGroot (1927) reports the introduced ribbed mussel, *Geukensia demissa* (Dillwyn, 1817) (Bivalvia: Mytilidae), trapping its valves onto the toes and beaks of foraging clapper rails, *Rallus longirostris* Boddaert, 1783, in San Francisco Bay, California. In addition to personally removing a mussel from a nesting chick's toe, the author estimated 75% of the rails in the region had lost one or more toes to ribbed mussels and inferred frequent mortality, especially for rail chicks. Plummer and Goy (1997: 88, fig. 1) documented, in graphic detail, a living adult pondmussel, *Ligumia subrostrata* (Say, 1831), causing mortality of a common musk turtle, *Sternotherus odoratus* (Latrielle, 1802), in

Figure 1. Yellow perch (*Perca flavescens*) (5.0 cm) trapped within eastern Elliptio (*Elliptio complanata*) (8.3 cm).

a similar fashion in Salado Creek, near Floral (Independence Co.), Arkansas, in 1996. The mussel was found to be a 73.2 mm gravid adult female that had apparently closed its valves upon the turtle's neck just ventral to the siphons laterally compressing it to 2.4 mm causing mortality either by drowning or suffocation.

Freshwater mussels are known to feed on a variety of particles including bacteria, protozoans, and phytoplankton (Coker et al., 1921; Gatenby et al., 1996; Nichols & Garling, 2000; Paterson, 1986; Yeager et al., 1994). Active feeding by mussels on fish, hosts or otherwise, has never been documented, however, nor is it implied here.

Mantle displays by various species of freshwater mussels have been shown to elicit attacks by various fish resulting in gill and body infestations of the fish by mussel glochidia (Haag & Warren, 1999; Kat, 1984), but have not been demonstrated for eastern Elliptio despite extensive morphological study of this species (Downing et al., 1993; Kesler & Bailey, 1993; Matteson, 1948, 1955; Watters et al., 2005; Weir, 1977; Wiles, 1975a, b; Young, 1911). Yellow perch is a confirmed glochidial host for eastern Elliptio along with seven other common freshwater fish species (Lefevre & Curtis, 1912; Matteson, 1948, 1955; Tedla & Fernando, 1969; Weir, 1977), nearly all of which are present in Massachusetts waters (Hartel et al., 2002). The collected specimen was not found to be gravid and no encysted glochidia were found on the trapped fish. Although speculative, it is unlikely the trapped yellow perch was attracted to any sort of display behavior.

The combination of wide habitat preference, large scale distribution, high densities, and glochidial transformation capability on multiple, common fish hosts indicates *Elliptio complanata* is an ecological generalist. The mortality of the yellow perch in this case may have been incidental. Although speculative, it is not likely the mussel was attempting to feed on the fish nor luring the fish in order to infect it with glochidia. The mussel may have been filtering with its valves agape and the fish somehow managed to find itself in the wrong place at the wrong time. A paucity of similar observations in the literature despite numerous, long-term studies of freshwater mussels in the past century indicates the observation presented here is a randomized, rare event that is not part of the typical life history of freshwater mussels.

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